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QUINCE CURCULIO, *CONOTRACHELUS CRATAEGI* WALSH (COLEOPTERA: CURCULIONIDAE), DEVELOPING IN APPLE, A NEW HOST, IN SOUTHERN NEW ENGLAND

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Abstract.—Adults of the quince curculio, *Conotrachelus crataegi* Walsh, occurred on apple trees in an abandoned orchard, and larvae developed in apple fruit in both the wild and the laboratory. Other insects reared from field-collected samples of apples were the plum curculio, *C. nenuphar* (Herbst), and the tachinid fly, *Cholomyia inaequipes* Bigot, which parasitized between 4.1 and 42.4% of the *Conotrachelus* larvae. The abundance of frugivorous adults and larvae of *C. crataegi* in the abandoned apple orchard indicated that a new race adapted to apple may be evolving.

Many native frugivorous insects have recently evolved new host races attacking introduced, closely related plants. For instance, the tephritid fly, *Rhagoletis pomonella* (Walsh), on native hawthorn (*Crataegus* spp.) has developed a race adapted to the introduced apple (*Malus* sp.) within the past 200 years (Bush, 1966; 1969). Similarly, the frugivorous quince curculio, *Conotrachelus crataegi* Walsh, and the plum curculio, *C. nenuphar* (Herbst), originally utilized native hawthorns and plums (*Prunus* spp.), respectively, but now also develop in introduced quince (*Cydonia oblonga* Mill.), pear (*Pyrus communis* L.), and others (Slingerland, 1898; Wellhouse, 1922; Schoof, 1942). Only *C. nenuphar* is known to infest apple. Here I document that *C. crataegi* also successfully develops on apple.

MATERIALS AND METHODS

Conotrachelus crataegi and *C. nenuphar* adults on trees, larvae in fruit, or both were collected in an abandoned apple orchard (≅1 ha) in Mt. Carmel, Connecticut and in mixed roadside stands of apple and native hawthorn in Storrs and Torrington, Connecticut. In Mt. Carmel, four Baldwin apple trees located <40 m from four quince trees, which produced <10 fruits per tree/year, were sampled for adults on nine mornings between 24 June and 11 August 1977. Outer tree limbs were struck with a pole to dislodge weevils

Table 1. Collection records for *Conotrachelus crataegi* and *C. nenuphar* adults on Baldwin apple trees in 1977.

Date of Collection	Number	
	C. crataegi	*C. nenuphar*
24 June	5	7
27 June	9	10
1 July	14	7
4 July	10	9
7 July	14	11
14 July	22	5
21 July	2	5
28 July	9	5
11 August	5	8
Total	90	67

(a sampling method known as jarring). Between November and April 1977–78 and 1978–79, leaf litter (2 cubic meters) obtained near the same four apple trees was placed in Berlese funnels to collect overwintering adult *C. crataegi*.

Larvae from each field sample (2 bushels for apples and 1000 fruits for *Crataegus*) were collected daily for one month as they emerged from fruit placed on screens in a greenhouse. They were transferred to plastic crispers containing moist, sterilized soil in which they pupated. Crispers were kept in a growth chamber maintained at 24 ± 1°C and on a 16-hour light: 8-hour dark photoperiod. Most adults of the weevils and their parasitoids emerged from the soil within two months, but others required chilling at 4 ± 2°C for four months before they completed development.

Twenty *C. crataegi* adults jarred from trees in Mt. Carmel were confined in a 31 cm (long) × 23 cm (wide) × 10 cm (deep) crisper. Fresh apples were supplied weekly, and old apples were placed in another crisper with moist, sterilized soil. Adults that emerged from the soil were used to start a second generation.

The body length of unsexed *C. crataegi* adults reared from hawthorn and apple fruits was measured with a Wild M-5 stereoscope equipped with an ocular micrometer. Lengths are reported as mean ± standard error.

Results and Discussion

Adults of *C. crataegi* and *C. nenuphar* occurred on apple trees on all sampling dates (Table 1). The total number of *C. crataegi* adults was probably greater because most sampling was conducted when individuals of *C. crataegi* normally emerge as adults from the soil (Slingerland, 1898) and when individuals of *C. nenuphar* are developing as larvae in apples or as pupae in the soil (Garman and Zappe, 1929). The large number of *C. cra-*

Table 2. Number of adults of *Conotrachelus crataegi*, *C. nenuphar*, and the parasitoid *Cholomyia inaequipes* reared from apples collected on the ground in Mt. Carmel, Connecticut in 1977–1978.

Date of Collection	Apple Variety	Location in Orchard	Number (%)		
			C. crataegi	*C. nenuphar*	*C. inaequipes*
14 July 1977	Baldwin	Edge	17 (2.8)	328 (54.8)	254 (42.4)
1 July 1978	Baldwin	Edge	0	909 (95.9)	39 (4.1)
12 July 1978	Gravenstein	Center	0	170 (87.2)	25 (12.8)
17 July 1978	Baldwin	Edge	30 (17.6)	94 (55.3)	46 (27.1)
19 July 1978	Gravenstein	Center	3 (0.8)	244 (68.4)	110 (30.8)

taegi in the sampling area and the limited supply of quince in the immediate vicinity indicated that this weevil was utilizing a new host, probably apple.

In contrast to Slingerland's (1898) report, *C. crataegi* successfully developed on apples in the laboratory for two generations (after which the rearing was discontinued). Adults obtained from apple trees readily fed on apples and mated and females oviposited on apples in the laboratory.

Larvae of *C. crataegi* also emerged from apples collected in the wild and subsequently developed to adults (Table 2). I reared adults of *C. crataegi* from three of five samples and adults of *C. nenuphar* and the *Conotrachelus* parasitoid, *Cholomyia inaequipes* Bigot (Diptera: Tachinidae), from all samples taken at Mt. Carmel. In the 17 July 1978 sample, *C. crataegi* adults accounted for 17.6% of the total number of reared weevils and parasitoids. The *C. crataegi* infestation was apparently greater in apples sampled near the edge of the orchard (closer to the quince) and later in July. *Cholomyia inaequipes*, whose biology is poorly known, parasitized between 4.1 and 42.4% of the *Conotrachelus* larvae. In 1978, parasitism increased from the first to last samples.

Conotrachelus crataegi larvae emerged from quince collected in Mt. Carmel and from *Crataegus* fruits collected in Storrs and Torrington in September and October 1978. The October sample of 1000 *Crataegus* from Torrington produced 46 *C. crataegi* adults and 1 *Cholomyia inaequipes* adult. By contrast, apples picked from a nearby tree on 31 July 1978 yielded 66 *C. nenuphar* and no *C. crataegi* or *C. inaequipes* adults. Apples collected at the same site in September also contained no *C. crataegi* larvae.

Adults of *C. crataegi* reared from apples collected at Mt. Carmel and from hawthorns collected at Torrington measured respectively 5.92 ± 0.070 mm ($n = 27$) and 4.87 ± 0.043 mm ($n = 46$) in length. This significant difference in body length ($P < 0.001$, 2-tailed t-test) implies that there were either qualitative or quantitative nutritional differences in larval diet or genetic differences between the two weevil populations. Host transfer experiments should reveal the cause for the size difference and, if genetic, should provide evidence for a distinct apple (+ quince?) race of *C. crataegi*.

Another indication of a *C. crataegi* population adapting to apple is the recovery of six *C. crataegi* adults overwintering in the leaf litter near apple trees. In the only previous study, Slingerland (1898) found that *C. crataegi* passed the winter in the larval stage. A population of *C. crataegi* adults, which overwintered in diapause, could attack apples in the spring, as *C. nenuphar* does.

Conotrachelus crataegi that survive and reproduce on apple may have a selective advantage over those that continue to utilize quince and hawthorn, whose abundance is declining in many areas of New England. The mechanism and direction of the proposed host shift to apple requires detailed study, but evidence presented here indicates *C. crataegi* shifted from quince to apple and not from hawthorn to apple.

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